

TAVI in severe AS patients with poor renal function

Myeong-Ki Hong, MD. PhD

Professor of Medicine

**Cardiology Division, Severance Cardiovascular Hospital
Yonsei University College of Medicine, Seoul, Korea**

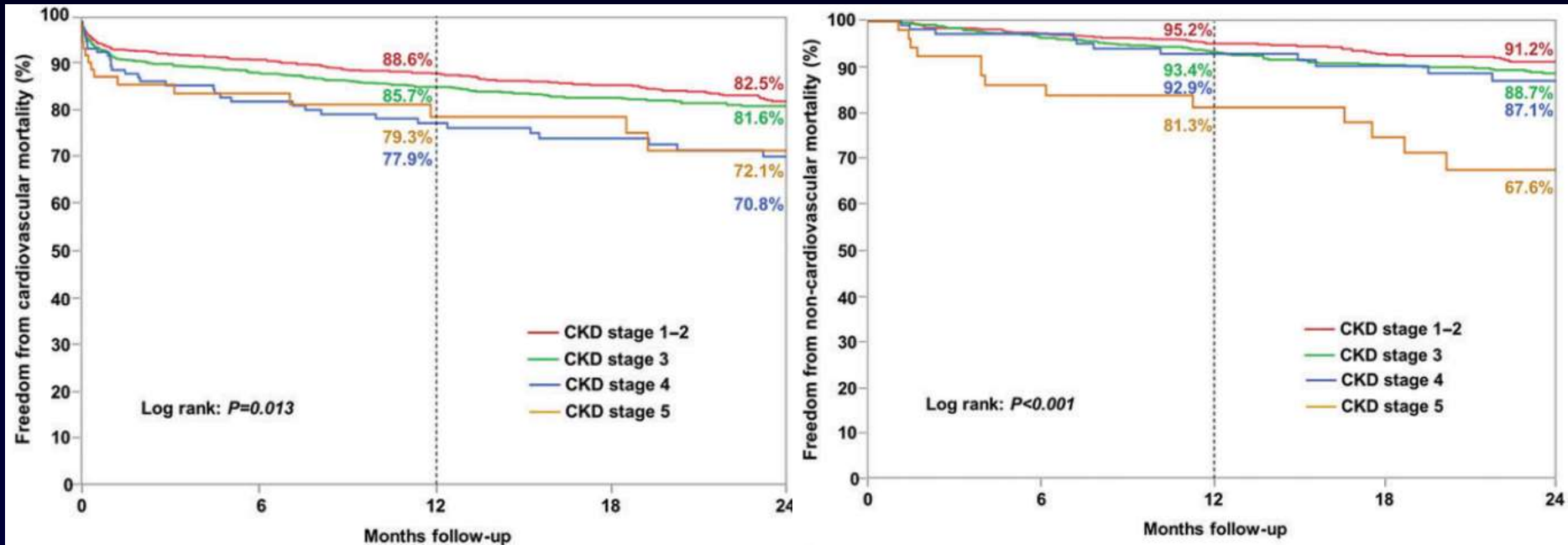
Declaration of Interest

- Proctor, Medtronic Evolut R

Clinical impact of CKD in patients with TAVI

Among 2,075 patients undergoing TAVI in Canada (During 2005-2012)

Prevalence of CKD grade ≥ 3 (eGFR <60 mL/min/1.73 m²) = 54%



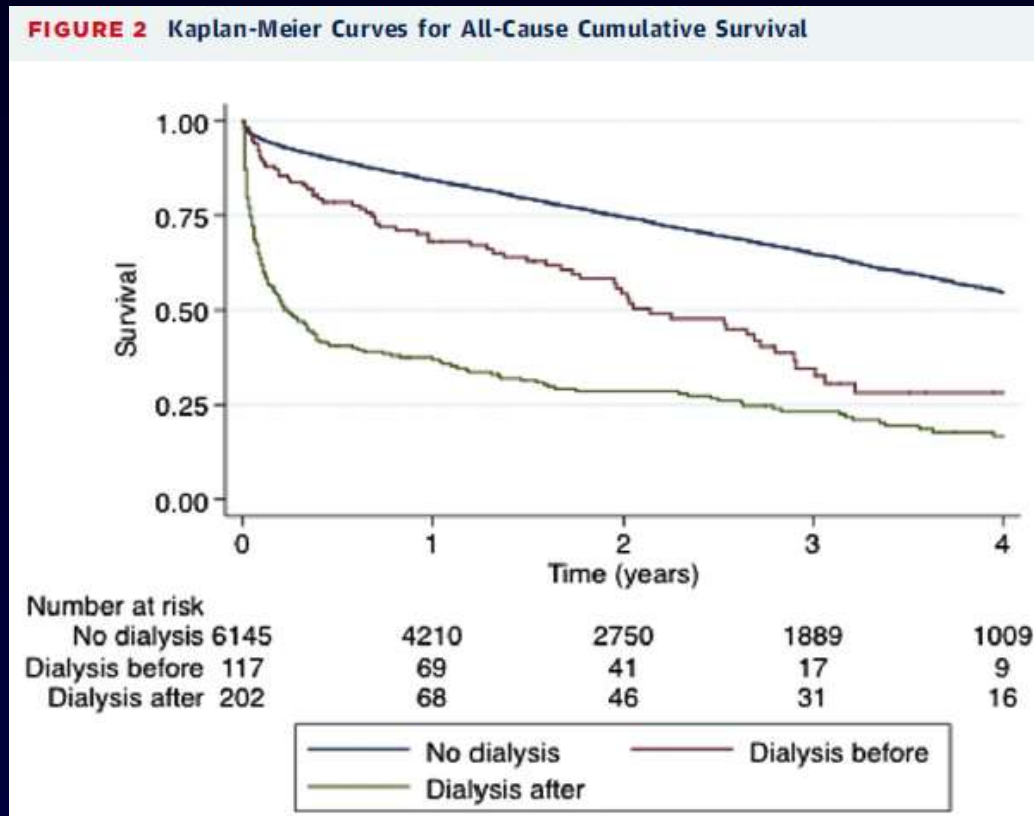
Advanced CKD in patients undergoing TAVI seems to determine a higher risk for early and mid-term cardiovascular and non-cardiovascular mortality

Allende R et al, EHJ 2014

Starting dialysis after TAVI

Among 6,464 patients undergoing TAVI in UK (During 2007-2014)

Incidence of dialysis after TAVI / before TAVI = 3.1% / 1.8%



Charles J. Ferro et al, *J Am Coll Cardiol Interv* 2017

Stages of AKI: VARC-2

Abrupt decrease in renal function within 7 days

Stage 1

Increase in serum creatinine to 150–199% ($1.5–1.99 \times$ increase compared with baseline) OR increase of ≥ 0.3 mg/dL (≥ 26.4 mmol/L) OR
Urine output < 0.5 mL/kg/h for > 6 but < 12 h

Stage 2

Increase in serum creatinine to 200–299% ($2.0–2.99 \times$ increase compared with baseline) OR
Urine output < 0.5 mL/kg/h for > 12 but < 24 h

Stage 3^b

Increase in serum creatinine to $\geq 300\%$ ($> 3 \times$ increase compared with baseline) OR serum creatinine of ≥ 4.0 mg/dL (≥ 354 mmol/L) with an acute increase of at least 0.5 mg/dL (44 mmol/L) OR
Urine output < 0.3 mL/kg/h for ≥ 24 h OR
Anuria for ≥ 12 h

The increase in Cr must occur within 48 h.

The timing for the diagnosis of AKI is extended from 72 h (VARC) to 7 days (VARC 2).

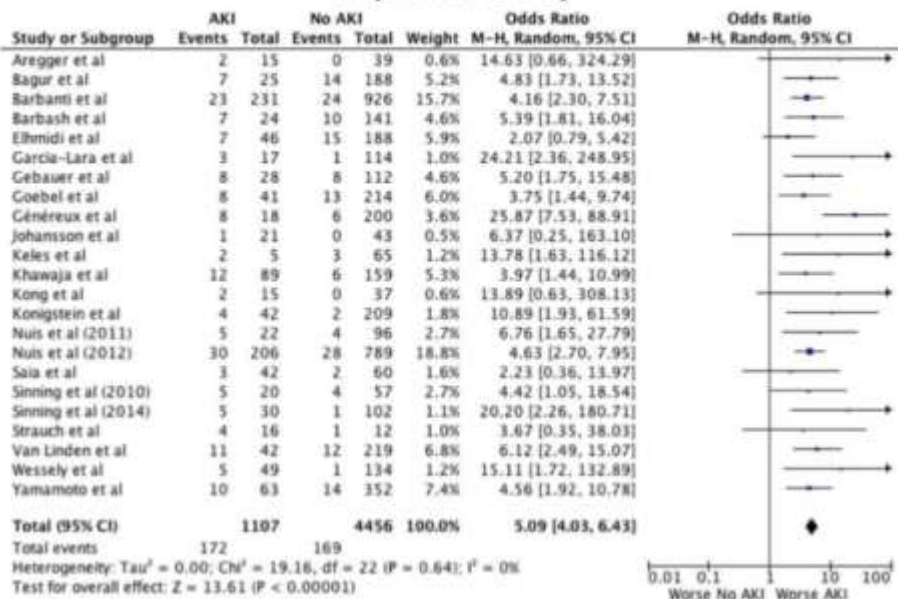
Eur Heart J 2012;33:2403

Meta-analysis of AKI and mortality after TAVI

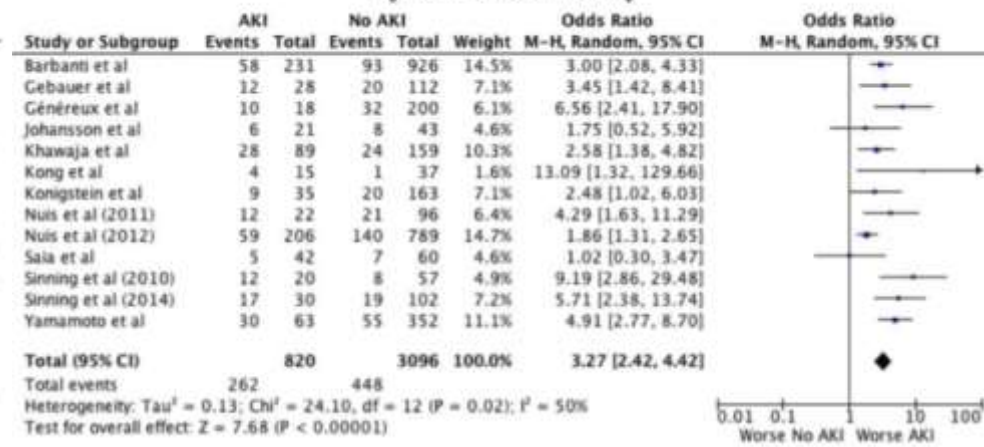
Among 5,971 patients in 24 clinical trials

Incidence of Postoperative AKI after TAVI = 22%

Early all-cause mortality



1-year all-cause mortality



Risk of AKI for early all-cause mortality = OR 5.09 (4.03-6.43)

Risk of AKI for 1-year all-cause mortality = OR 3.27 (2.42-4.42)

Gargiulo G et al. CCI 2015

Pathomechanisms of AKI during TAVI

- **Contrast agent**
- **Concomitant drugs**
- **Blood loss**
- **Rapid pacing with resulting hypotension and renal hypoperfusion**
- **Embolization during the implantation due to patient's age and frequent coexistence of atherosclerosis,**
- **Postoperative severe inflammatory response syndrome**

Contrast volume and AKI in TAVI procedure

Among 270 patients undergoing TA-TAVI in Germany (During 2006-2009)

Table 6. Significant risk factors for postoperative AKI after TA-AVI in univariate and multivariate analysis.

	Odds ratio (95% CI)	p-value
Univariate		
Procedure time > median (75 min)	2.1 (1.1–4.1)	0.034
Need for cardiopulmonary bypass	2.8 (1.1–7.0)	0.028
Intra-operative conversion to sternotomy	16.8 (1.7–165.4)	0.016
Contrast-agent burden > median (90 ml)	2.6 (1.3–5.2)	0.007
Contrast-agent burden > median (1.37 ml kg ⁻¹ body weight)	3.0 (1.4–6.1)	0.003
Number of blood transfusions > 4 ^a	3.7 (1.7–7.9)	0.001
New thrombocytopenia for more than 2 days ^a	7.6 (3.3–17.2)	<0.001
Leucocyte count > 12 G/l for more than 2 days ^a	3.6 (1.8–7.1)	<0.001
Multivariate		
Contrast-agent burden > median (90 ml)	2.3 (1.0–4.9)	0.038
Contrast-agent burden > median (1.37 ml kg ⁻¹ body weight)	2.5 (1.1–5.4)	0.023
New thrombocytopenia for more than 2 days ^a	4.4 (1.6–12.2)	0.005
Leucocyte count > 12 G/l for more than 2 days ^a	2.8 (1.3–6.0)	0.009

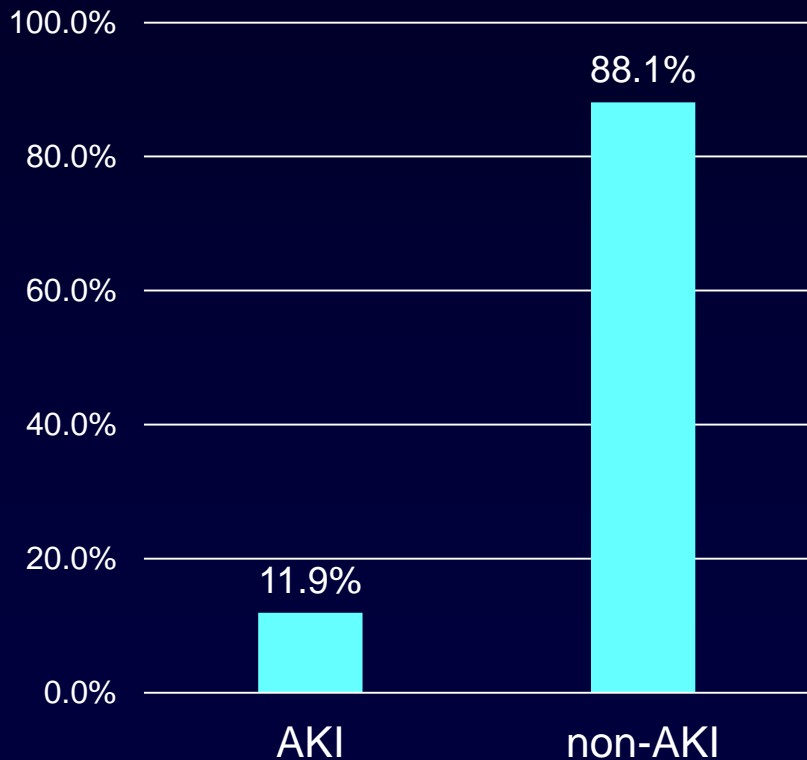
“Postoperative AKI and RRT depend on the amount of intra-operative contrast agent. These results strongly support the need for intra-operative tools to reduce contrast-agent exposition during TA-AVI.”

Van Linden A et al, European Journal of Cardio-Thoracic Surgery 2011

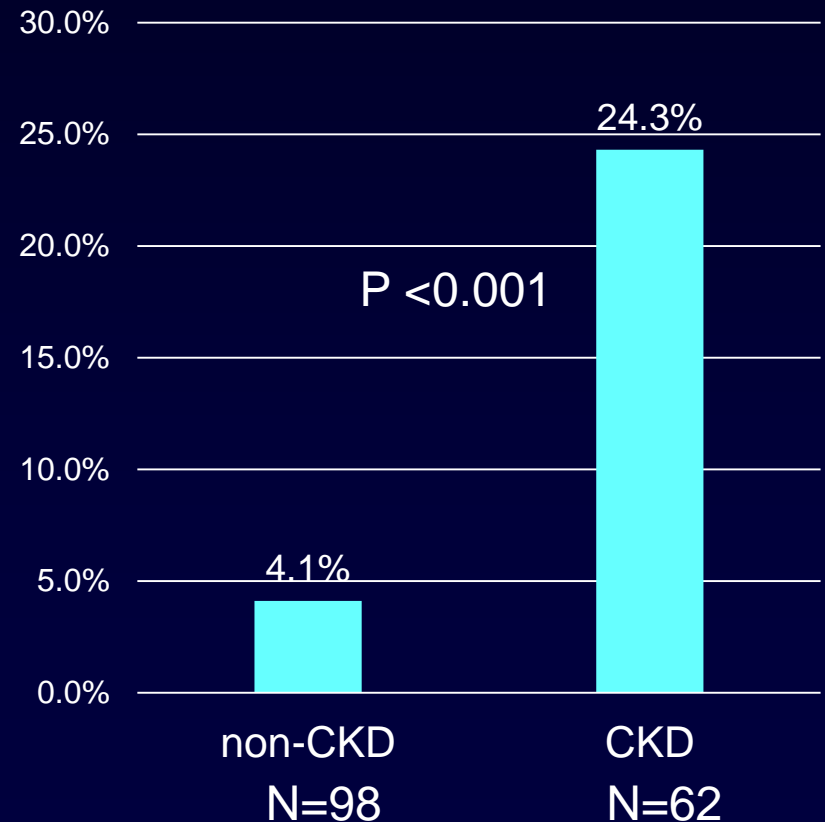
Severance Hospital: Incidence of AKI after TAVI

- From July 2011 to April 2018, 180 TAVI patients (mean age 81.6 years old)
- **CKD stage 3~5 (GFR<60 mL/min): 45.6%**

Among non-dialysis patients (n=160)



Non-CKD vs CKD



Zero-Contrast TAVR for Severe AS in Patient with CKD

Operator: Myeong-Ki Hong, Young-Guk Ko, Jung-Min Ahn

An 88-year-old female was admitted due to dyspnea (NYHA functional class III). She had a history of hypertension, diabetes, stage 4 chronic kidney disease (CKD), and persistent atrial fibrillation. Coronary angiography showed no significant stenotic lesion. Echocardiography showed normal left ventricular ejection fraction but severe aortic stenosis was noted (Figure 1). Aortic valve area was 0.96 cm² on the planimetry method. Peak velocity across aortic valve was 4.2 m/s, and mean pressure gradient was 30 mmHg. STS score was 8%.

Because of CKD, CT angiography was not done. From the 3D echocardiographic data, the mean annulus diameter was 24.6 mm and the perimeter was 71.2 mm. Distance from annulus to LM and RCA ostium was 16.3 and 15.8 mm, respectively. Because of stage

IV CKD, TAVR was planned without using contrast agent.

Under general anesthesia, temporary pacemaker was inserted through right femoral vein. 7 Fr sheath and 6 Fr pig-tail catheter were inserted through right femoral artery under sono-guided puncture technique. 8 Fr sheath was inserted through left femoral artery and replaced with 18 Fr Sentrant sheath. Straight coil

wire under back-up with an AL 1 diagnostic catheter was crossed the stenotic aortic valve. Then, straight coil wire was changed to the round-shaped Amplatz stiff wire. Under TEE guidance, a 29-mm Evolut R prosthesis was placed at the optimal position and



Figure 1

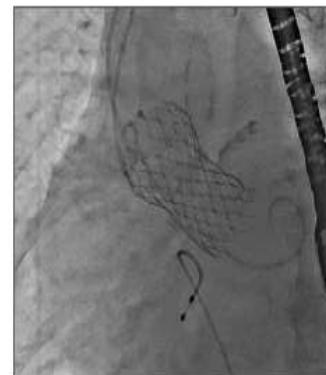


Figure 2

was deployed successfully (Figure 2). After valve implantation, follow-up TEE showed mild para-valvular leak and mild to moderate AR. AR index was 24. All procedure was finished.

Live demonstration in Severance Cardiovascular Hospital, 2017 October

2018 TCT AP live demonstration case (2018.5.1) : Zero contrast TAVI

83 year-old Female

Diagnosis

Severe AS – symptomatic

(recent syncope; CCS 1; NYHA class II)

Type 2 DM

Old CVA

CKD (stage IV)

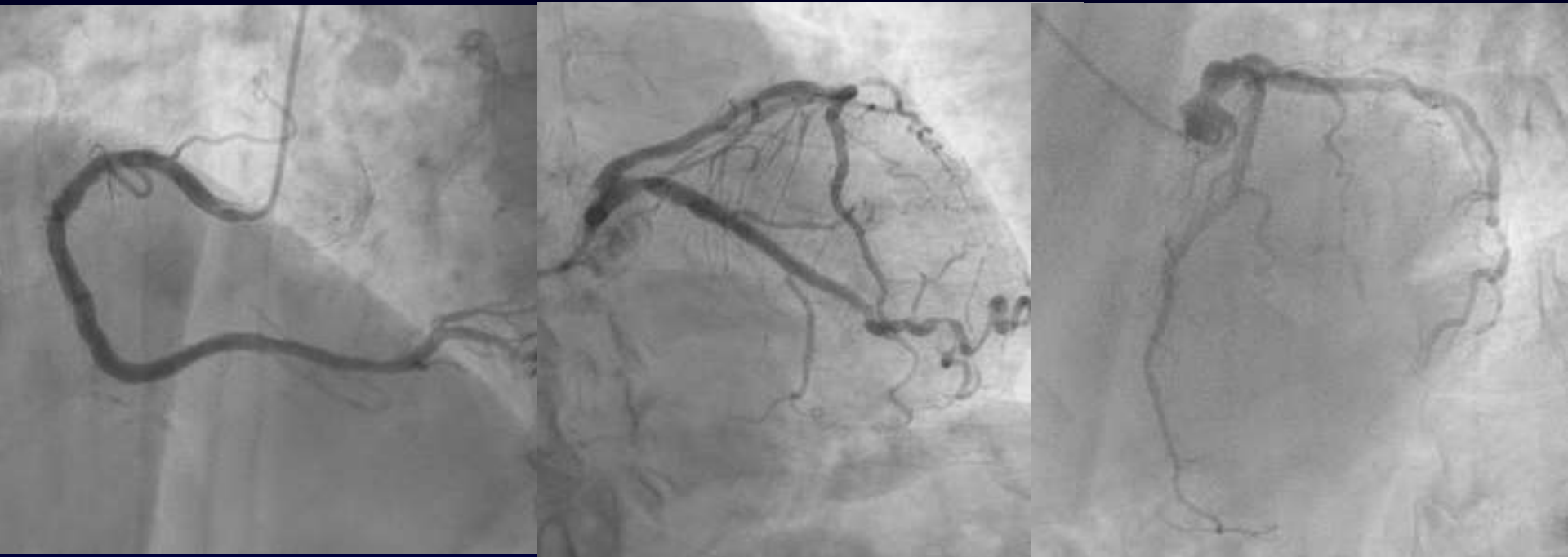
(Cr 2.7 mg/dL, eGFR 16 mL/min/1.73 m²)

CAD (2VD); S/P PCI at LCx and LAD (2013)

Risk score

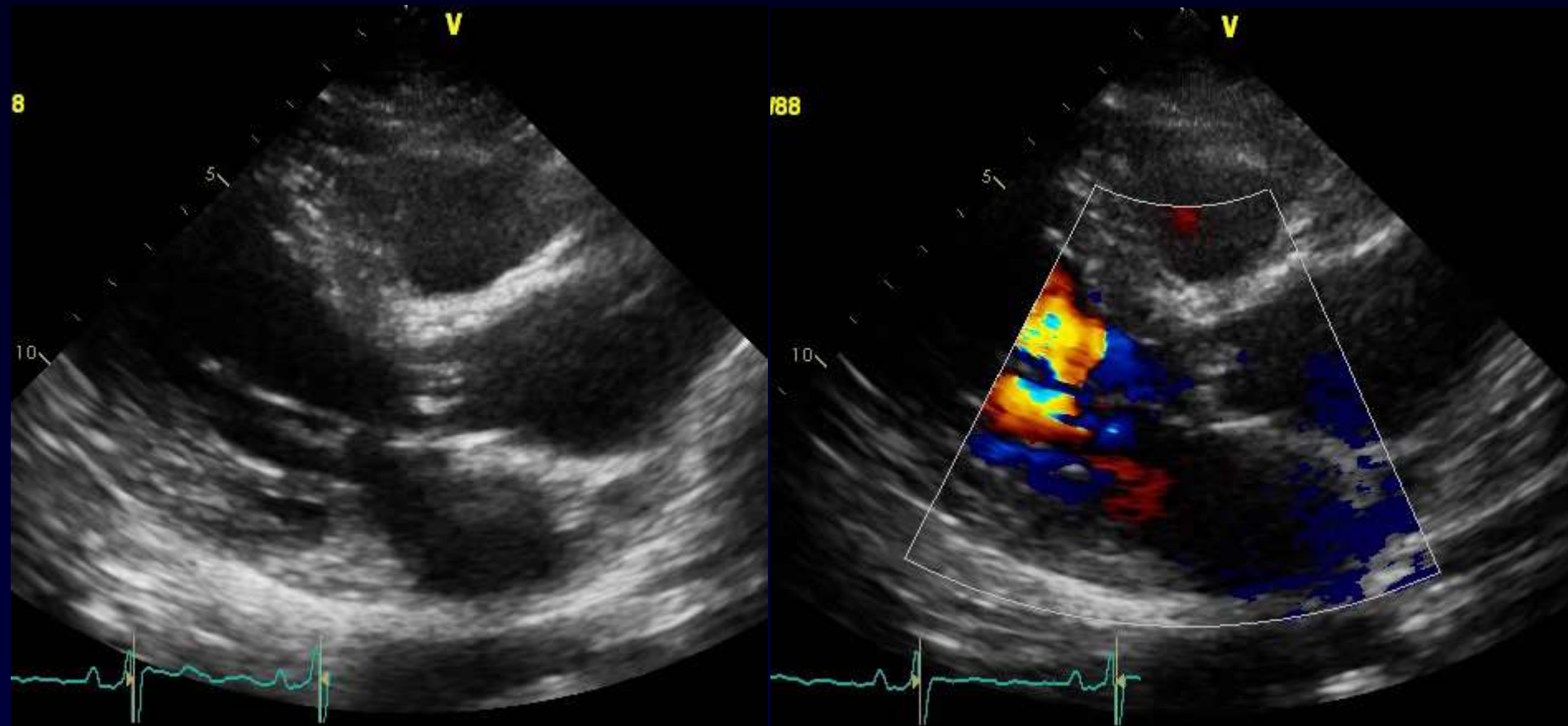
STS score = 15%

CAG – only 3 cuts taken (04 Apr 2018) for minimal contrast use



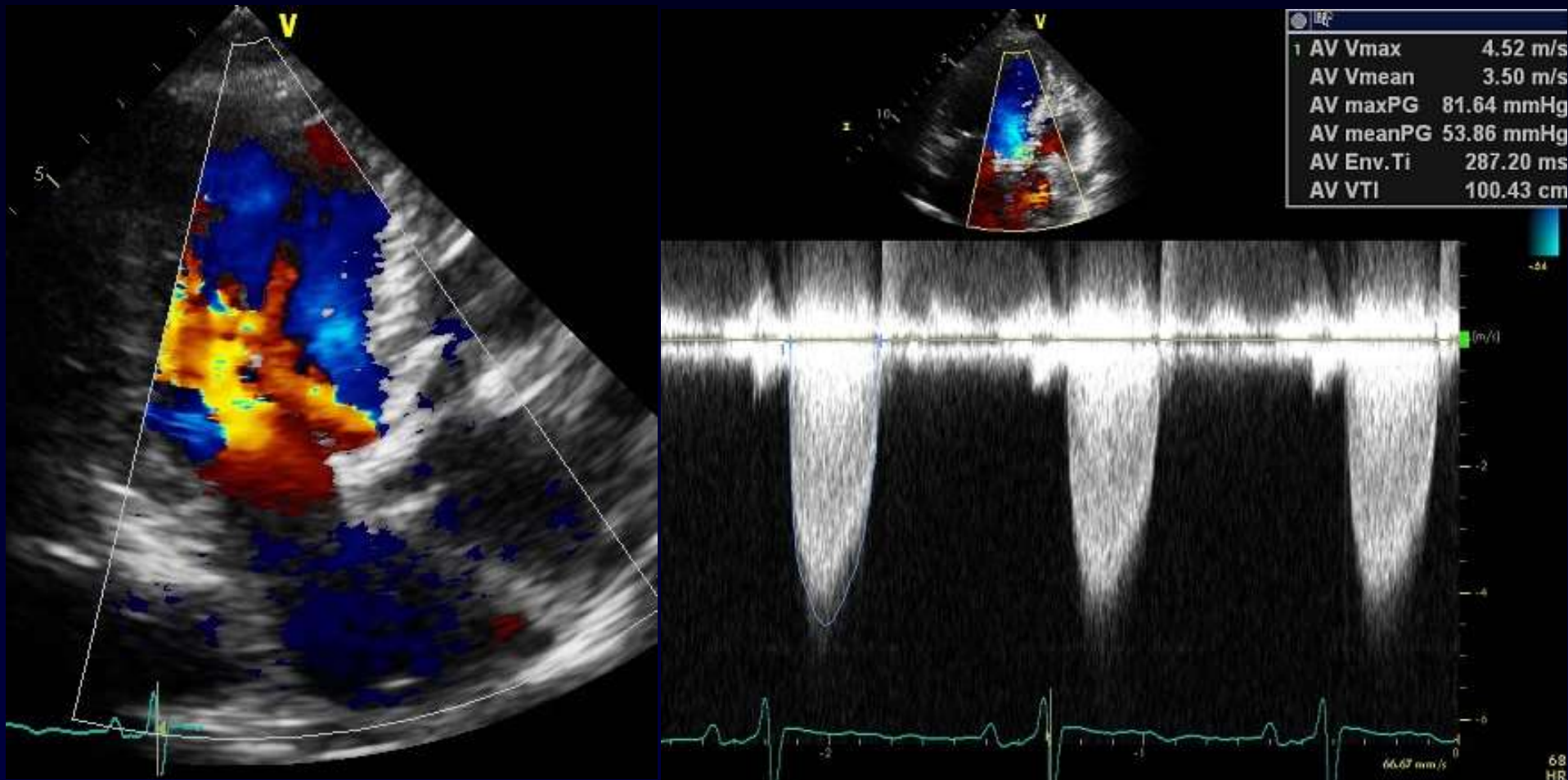
**Patent previous stents
(Xience 2.75*24 at LCx, Xience 2.75*28, 2.5*28 at LAD)**

TTE (2018-04-03)



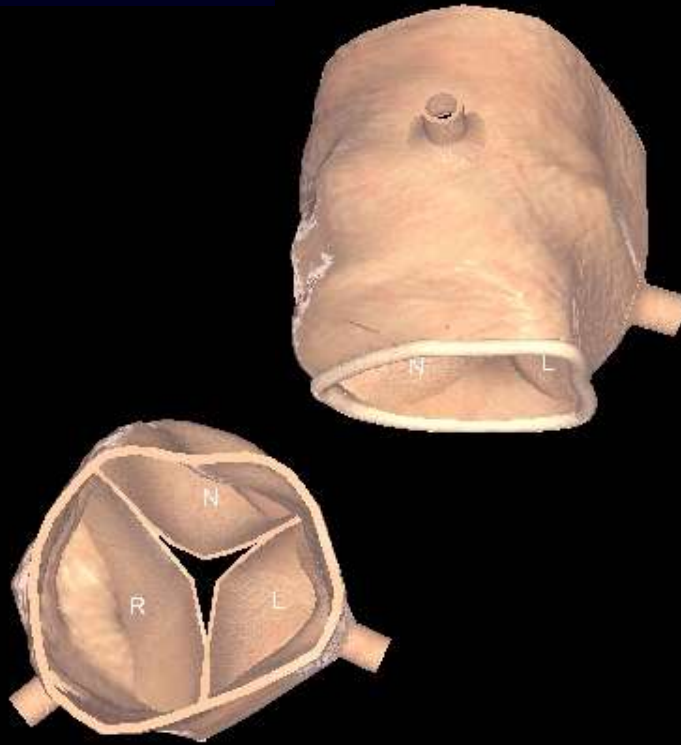
**Severe AS due to degenerative AV with moderate AR (Gr. II/IV)
Normal global LV systolic function (EF: 63%)**

TTE (2018-04-03)



PSPG/MSPG: 81/53 mmHg, AVA: 0.5 cm² by C.E.

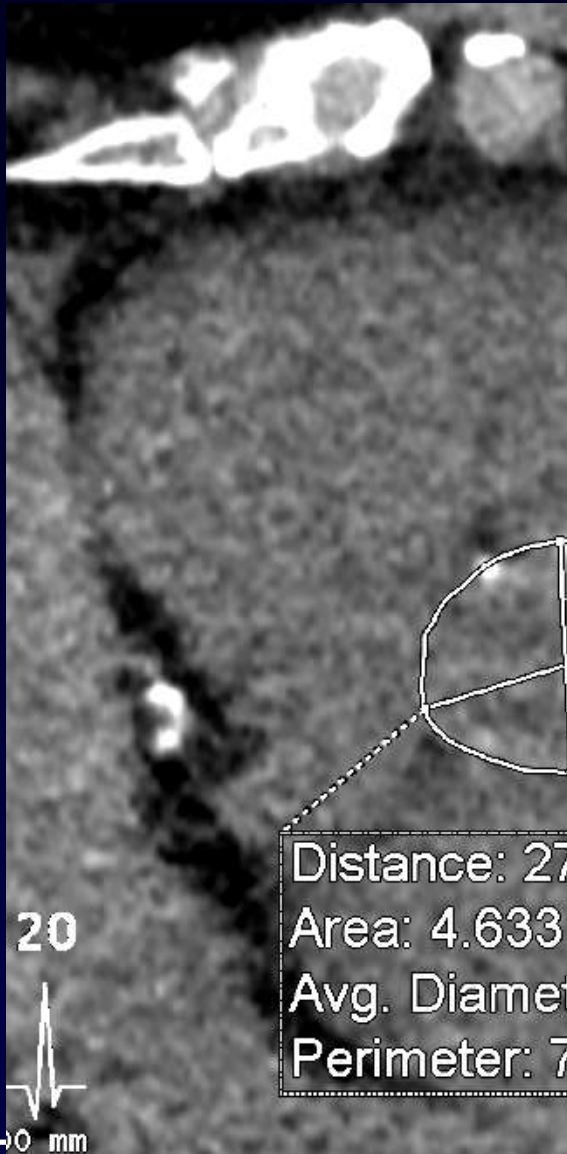
3D reconstruction : TEE assessment (2018-04-04)



Ann Diam (Perimeter De... 24.7 mm

Diagnosis	16 vps / 120 mm
Aortic Valve	Frame 7 7 / 28
Ann Min Diam	20.8 mm
Ann Max Diam	27.0 mm
Ann Perimeter	77.5 mm
Ann Area	437.3 mm ²
Root STJ Min Diam	27.3 mm
Root STJ Max Diam	33.0 mm
Root STJ Area	738.4 mm ²
Root STJ Perimeter	101.2 mm
Root SoV Min Diam	30.5 mm
Root SoV Max Diam	32.9 mm
Root SoV Perimeter	102.3 mm
Root SoV Area	796.0 mm ²
L Ostium Height	12.2 mm
R Ostium Height	19.5 mm
Valve Orifice Area	46.3 mm ²

Non-contrast CT (2018-04-03)



Annulus

Dimension = 21.6 x 27.5 mm

Avg. diameter = 24.3 mm

Area = 463.3 mm²

Perimeter = 77.5 mm

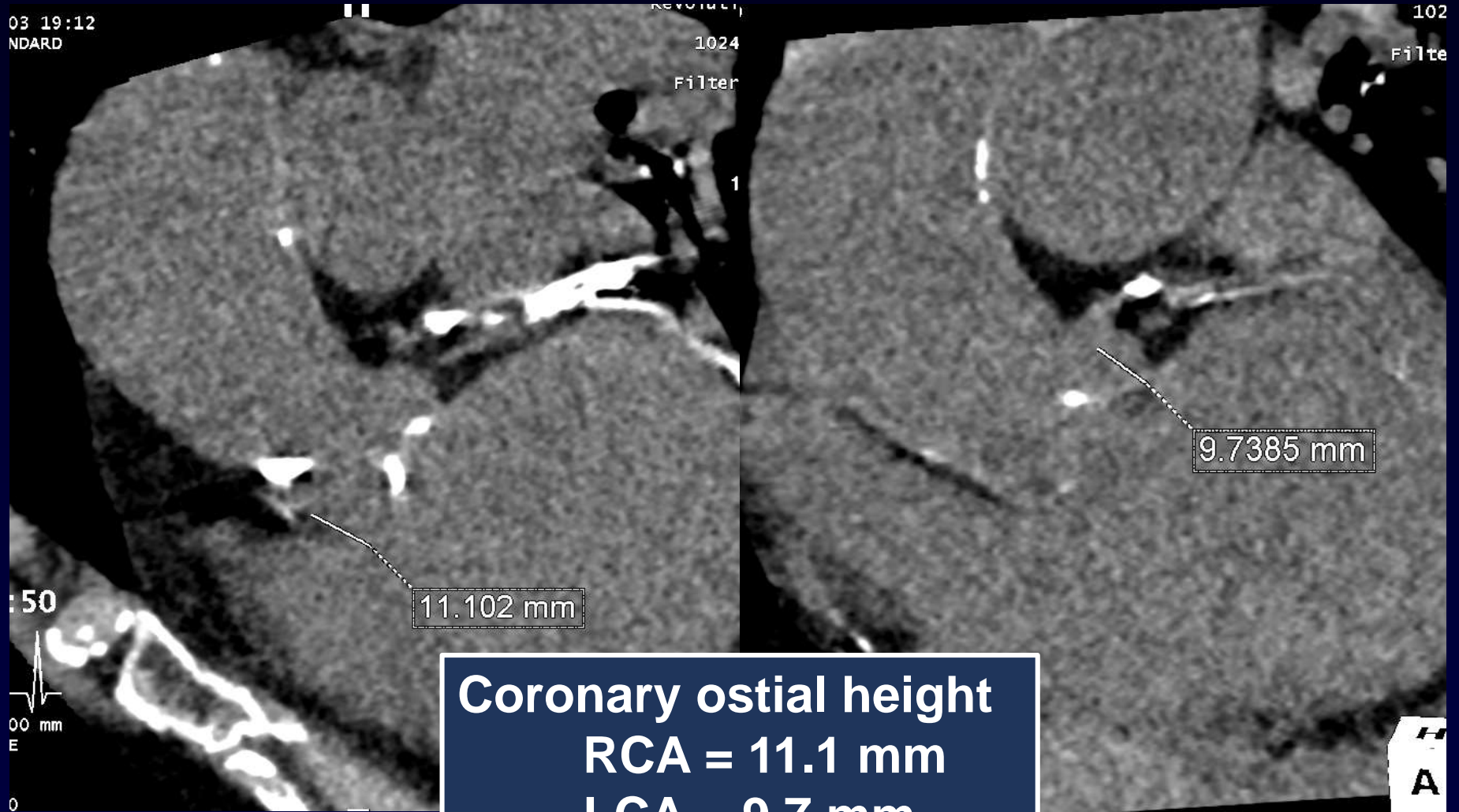
Distance: 27.499 mm x 21.588 mm

Area: 4.6331 cm²

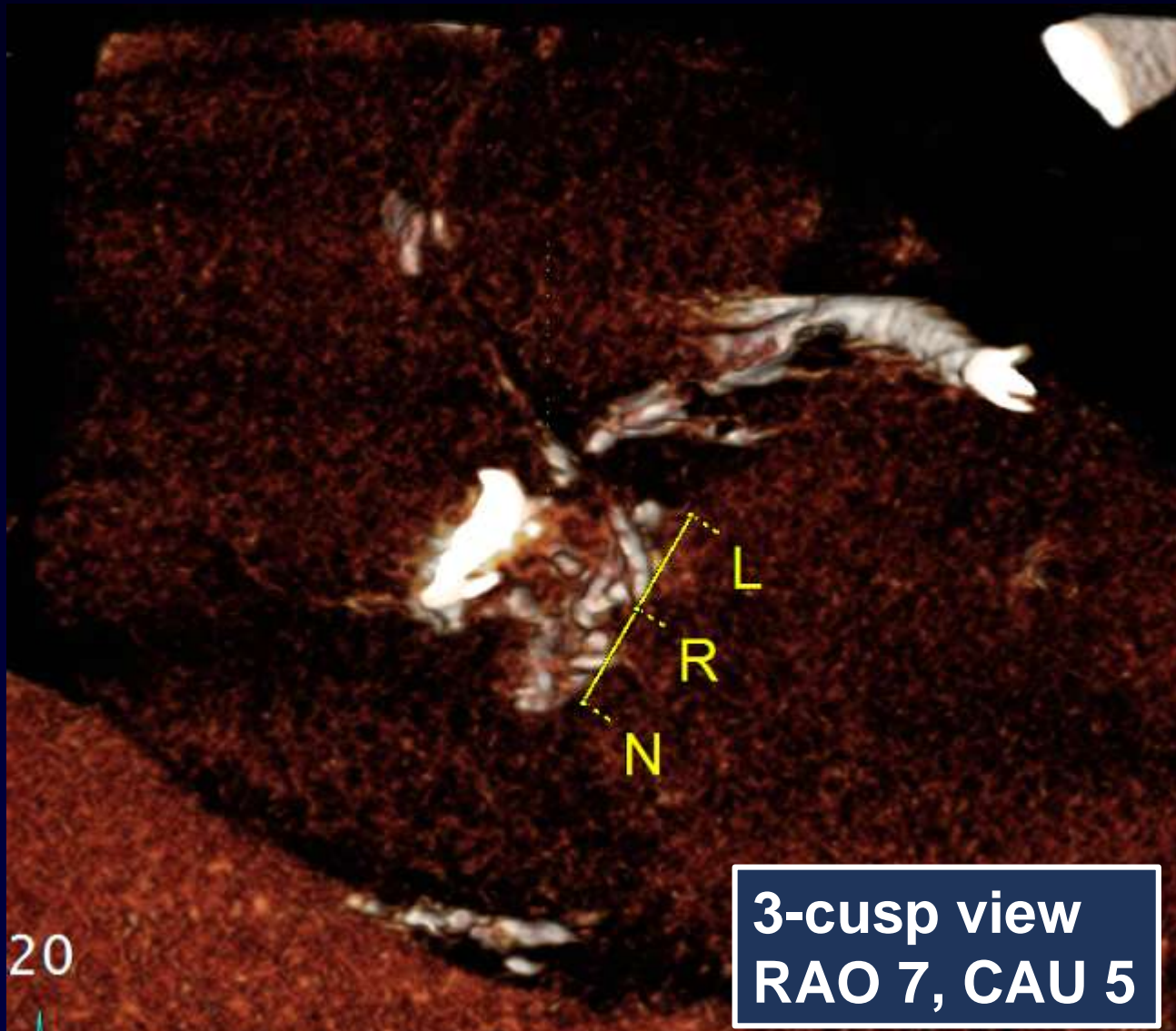
Avg. Diameter: 24.288 mm

Perimeter: 77.456 mm

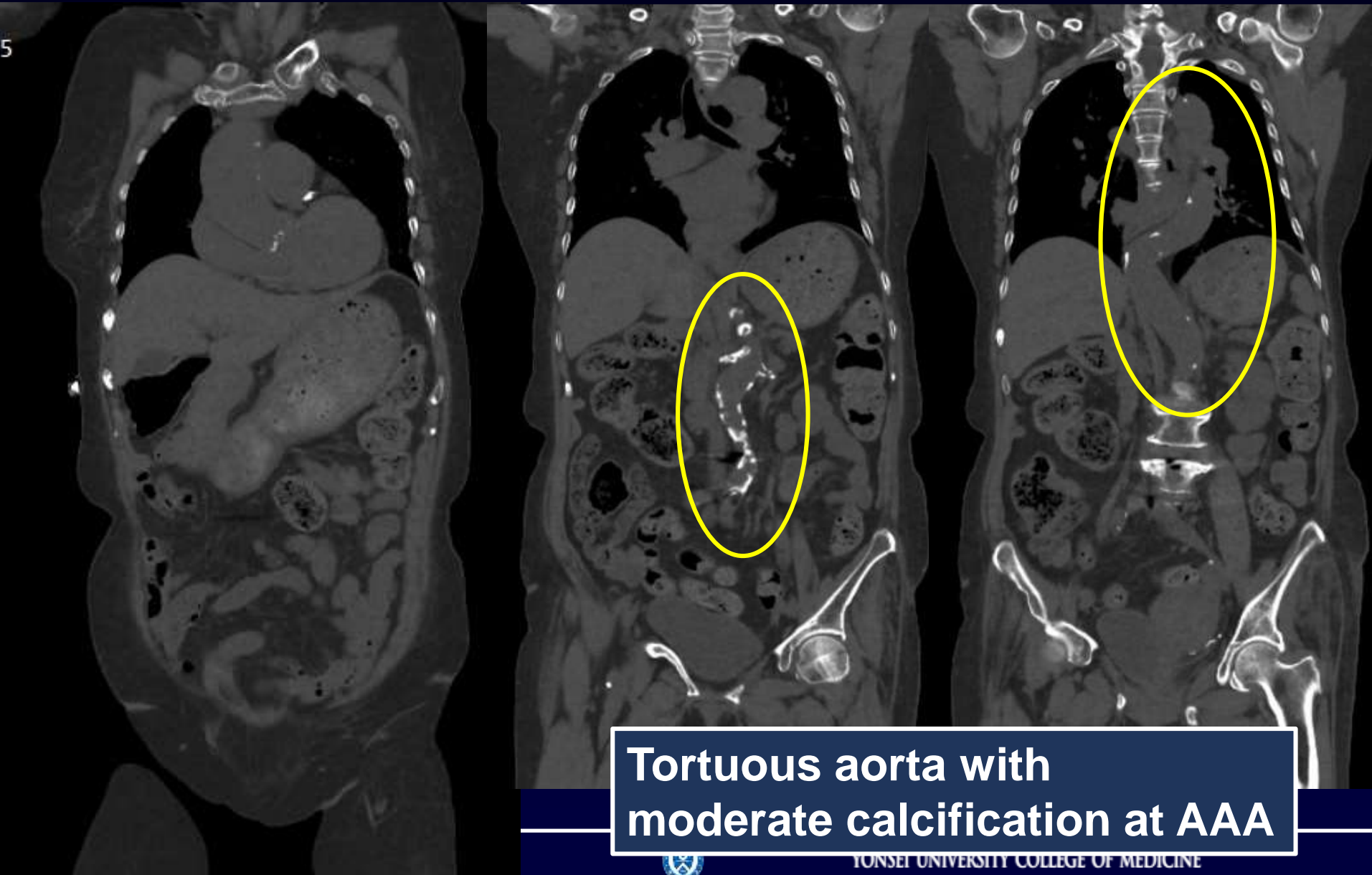
Non-contrast CT (2018-04-03)



Non-contrast CT (2018-04-03)



Non-contrast CT (2018-04-03)



**Tortuous aorta with
moderate calcification at AAA**

Lower extremity doppler

Rt. EIA = 6.3-6.4 mm

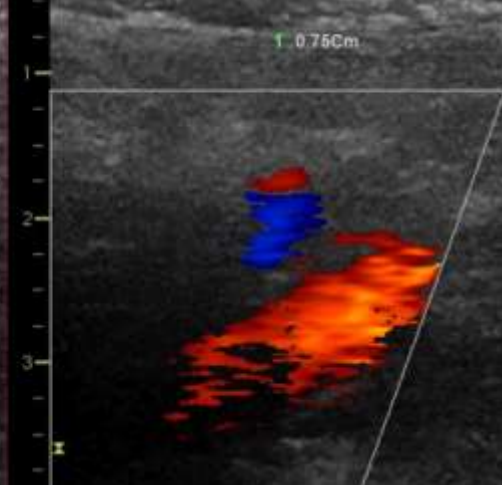
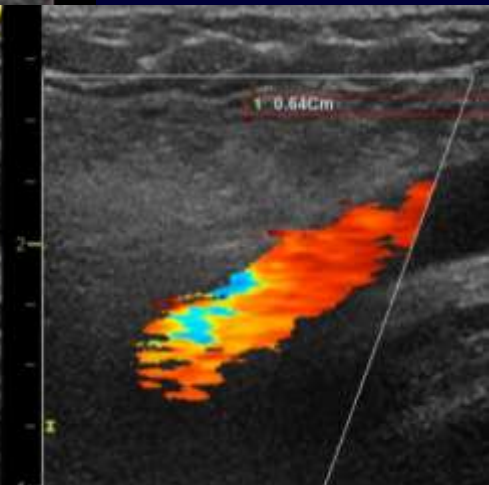
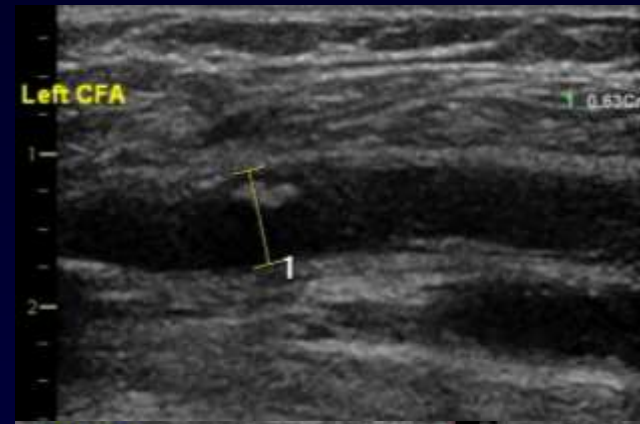
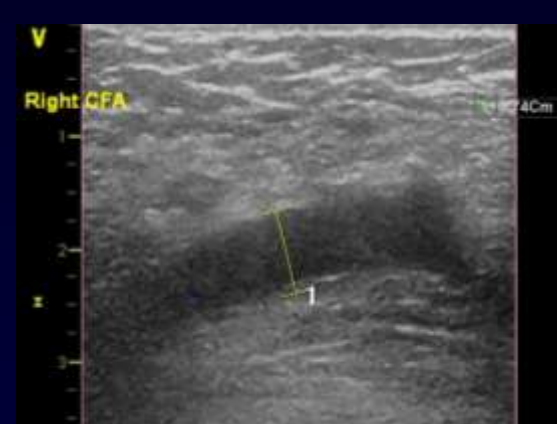
Rt. CFA = 7.4 mm

Rt. SFA = 6.0 mm

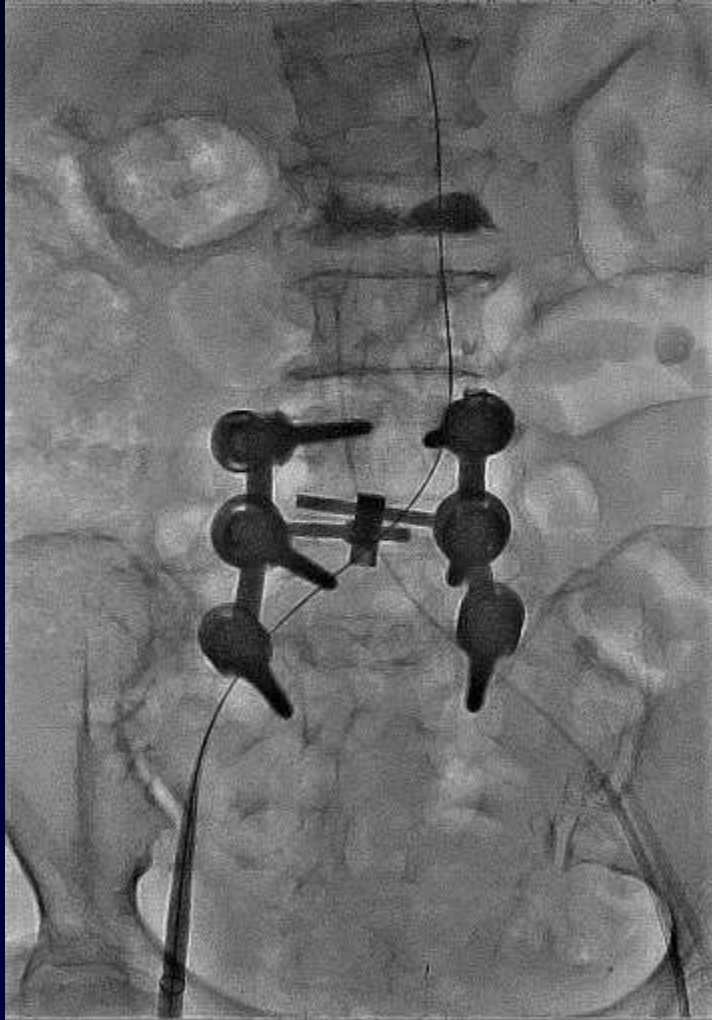
Lt. EIA = 7.1-7.5 mm

Lt. CFA = 6.3 mm

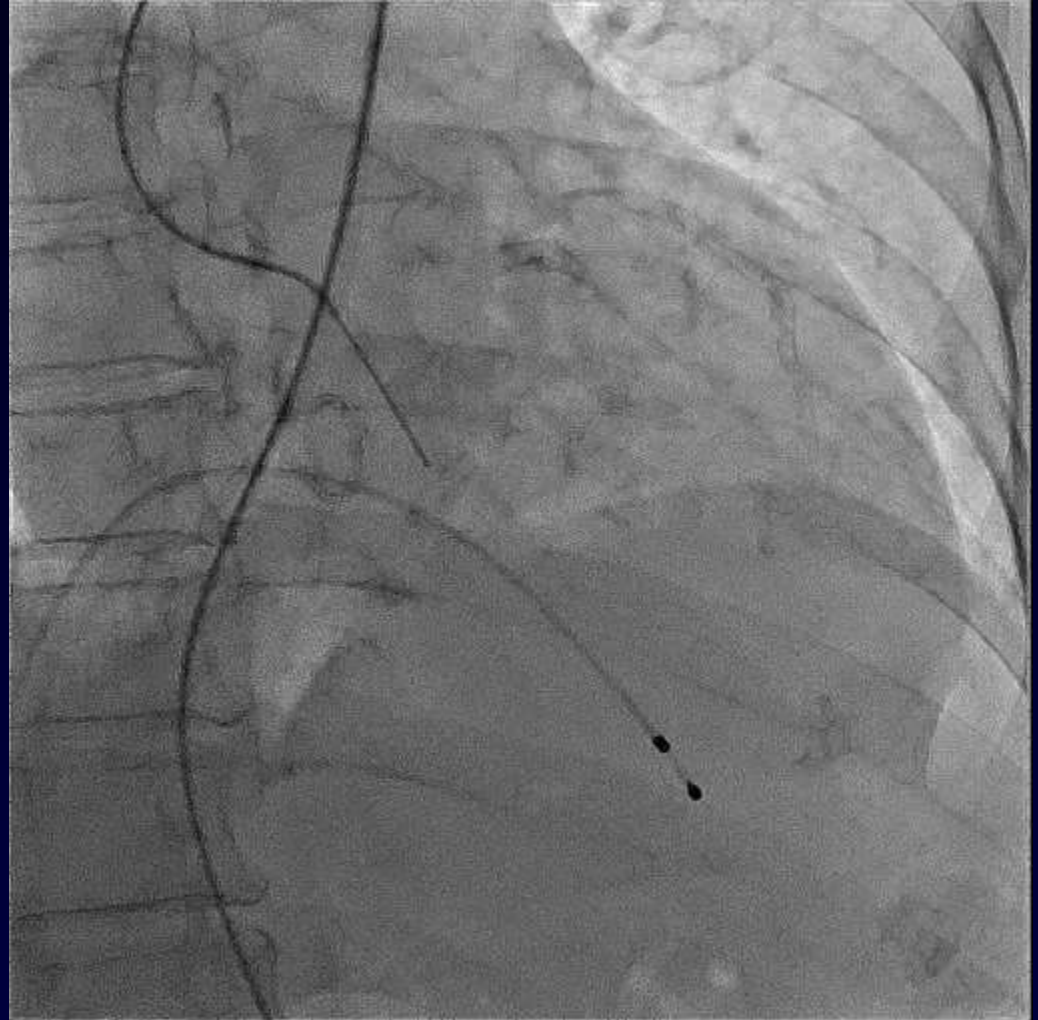
Lt. SFA = 5.7 mm



Sono-guided femoral artery puncture without contrast

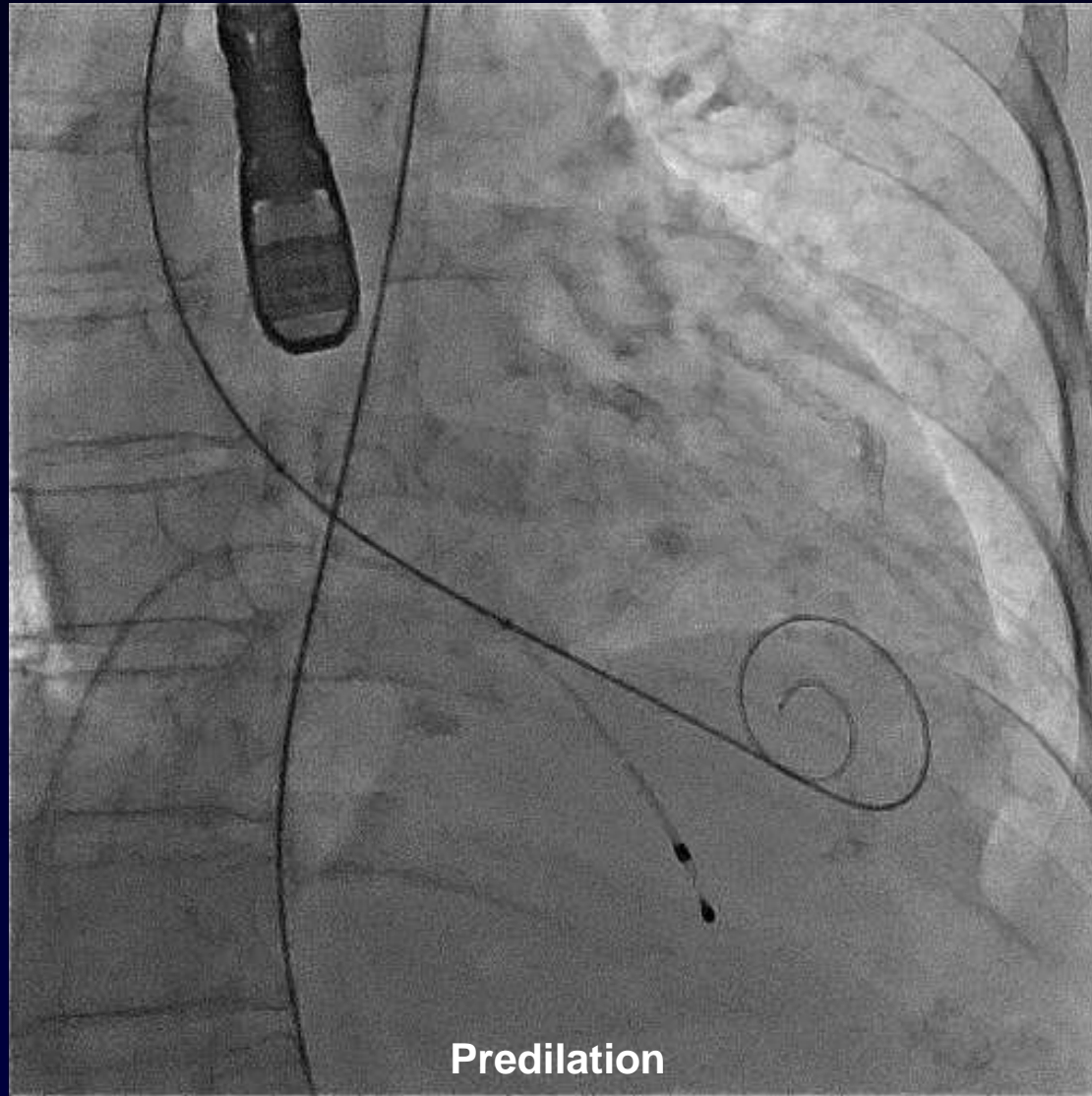


Insertion of delivery sheath
(after US-guided puncture)

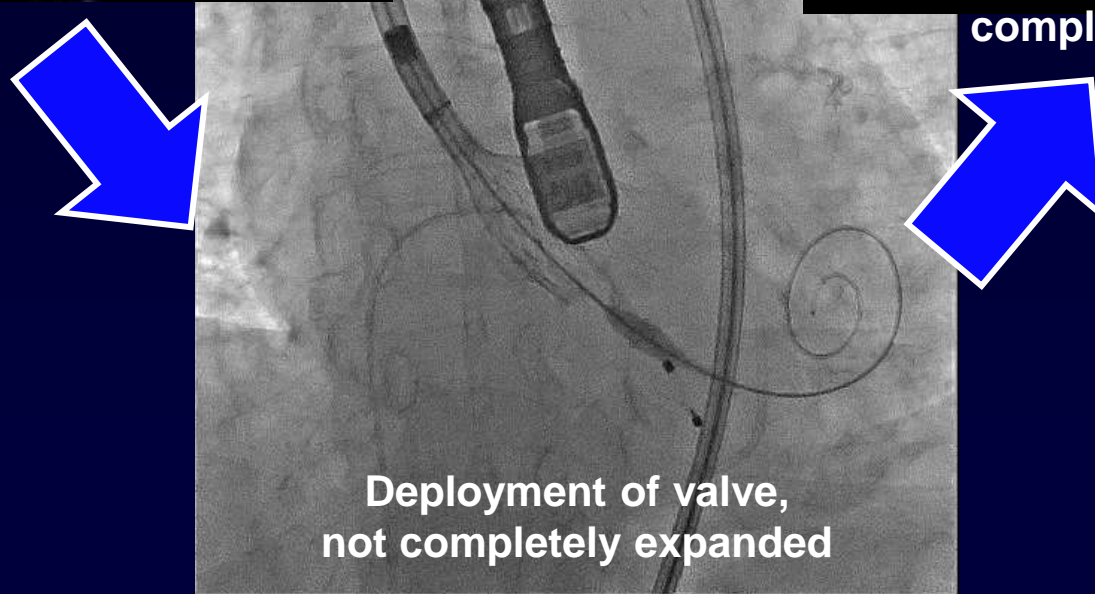
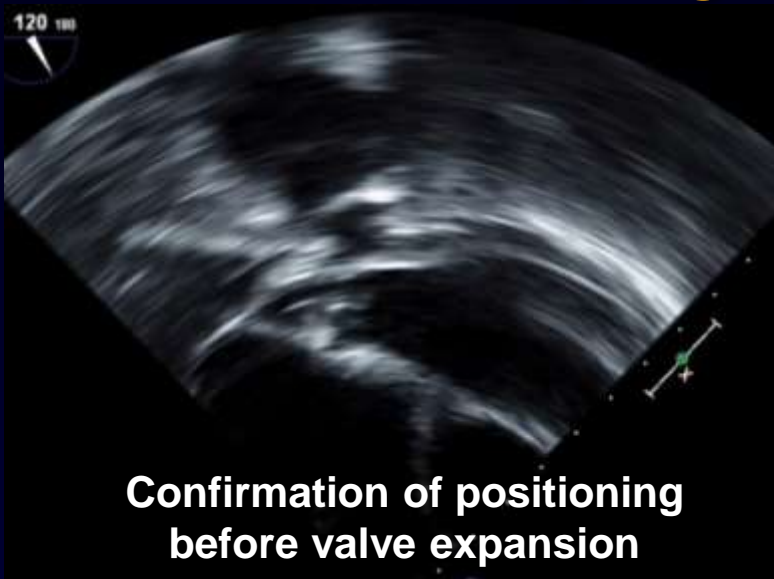


Introducing straight guidewire into LV

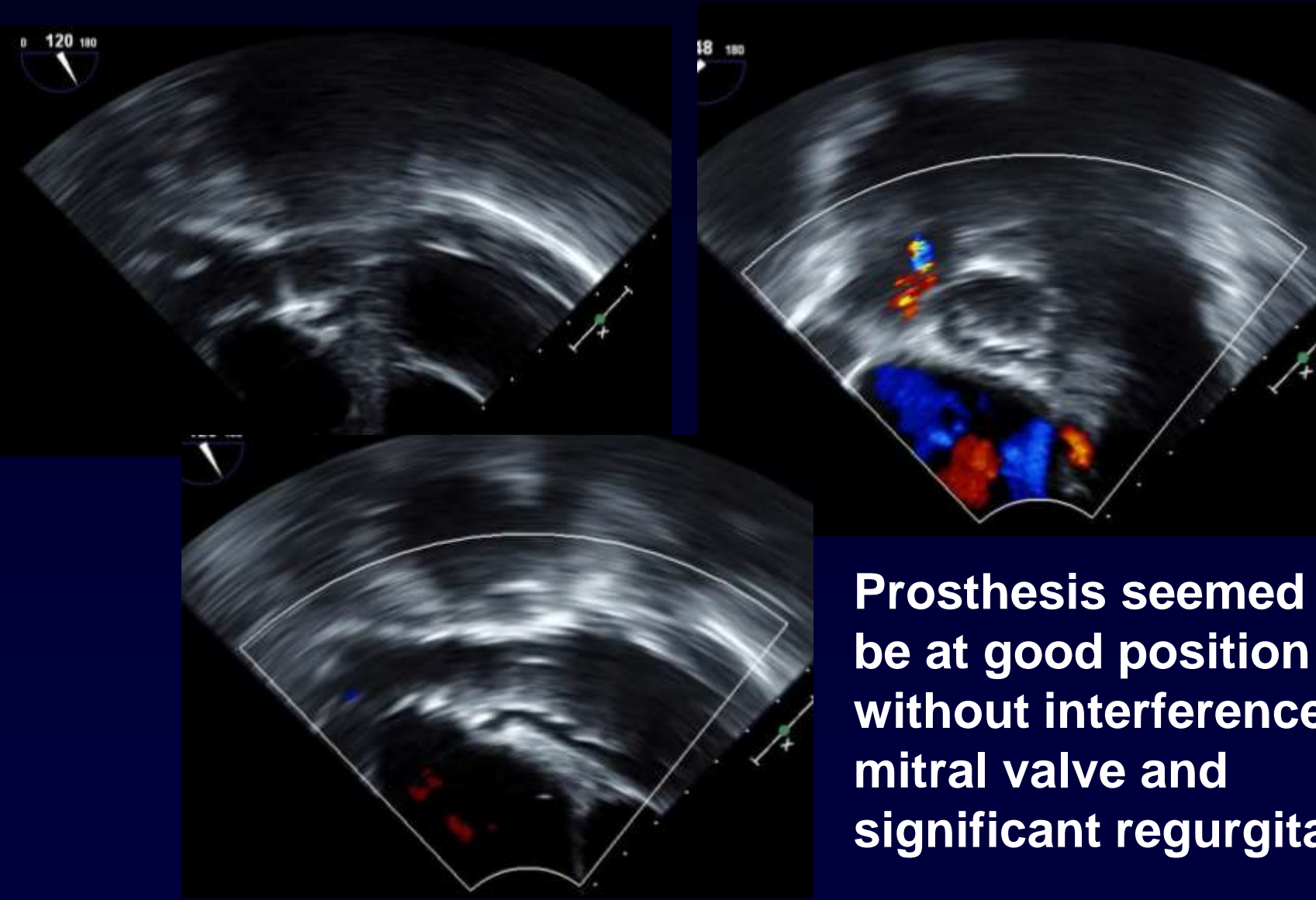
Transfemoral TAVI procedure



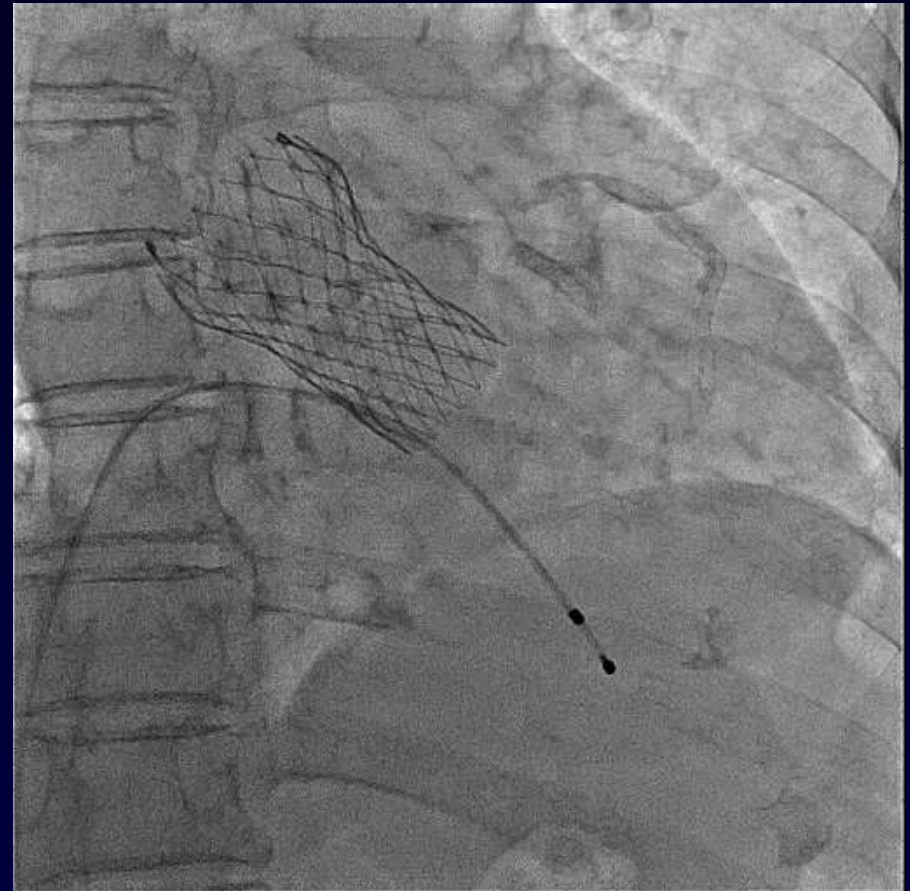
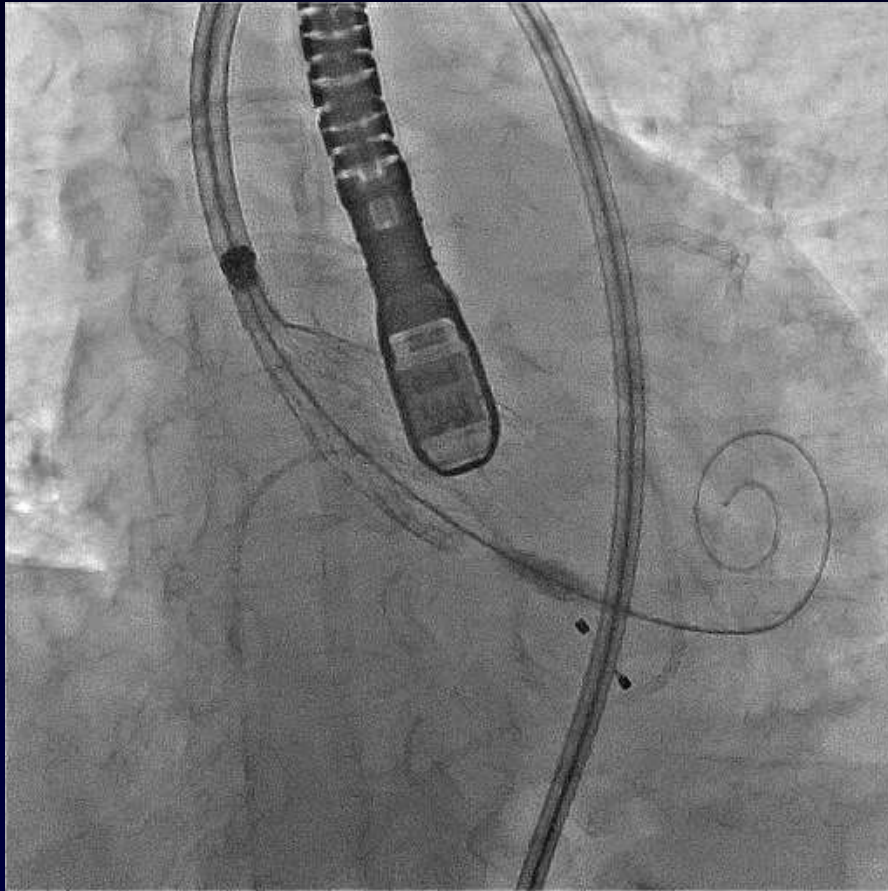
Valve deployment with TEE imaging



Analysis of TEE imaging



Deployment of valve



Total amount of contrast during TAVI = zero

Final evaluation of implanted valve



**Good working of
prosthetic valve without
other structural
abnormality**



[TCTAP 2018] Valve Symposium - Live Case Session IV



Non-Contrast TAVI

	TAVI date	Sex	Age	STS score	serum Cr	Ccr	DM	HTN	PCI
1	2017 10 13 (2017 KSC live)	F	88	8.0%	3.12mg/dl	14ml/min/1.73 m ²	Y	Y	ND
2	2018 01 16	F	81	6.1%	1.94mg/dl	25ml/min/1.73 m ²	N	Y	PTCA at p-mLAD, p-dLCX (2012)
3	2018 01 26	F	78	3.0%	1.69mg/dl	28ml/min/1.73 m ²	N	Y	PTCA at p-mLAD, m RCA (2012)
4	2018 02 27	F	87	17%	2.76mg/dl	16ml/min/1.73 m ²	N	N	ND
5	2018 02 27	M	76	2.7%	1.71mg/dl	35ml/min/1.73 m ²	Y	Y	ND
6	2018 05 01 (2018 TCT AP live)	F	83	15%	2.7mg/dl	16ml/min/1.73 m ²	Y	N	PTCA at LCx, LAD (2013)
7	2018 05 03	F	83	5.1%	1.75mg/dl	28ml/min/1.73 m ²	N	Y	ND
8	2018 07 31	F	80	11.4%	1.70mg/dl	29ml/min/1.73m ²	N	Y	ND

Poor general condition and fragile

Conclusions

Non-contrast TAVI using Evolut R should be considered in severe AS patients with poor renal function

Dreams will come true

